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Our Mission

To enhance the vitality, health, sustainability, and overall quality of life in New Jersey by developing and delivering practical, effective solutions to current and emerging challenges relating to agriculture; fisheries; food; natural resources; the environment; public health; as well as economic, community, and youth development.
NJAES Financial Overview

In the fiscal year that ended June 30, 2016, NJAES increased its total funding to $95.4 million to support its research and extension activities. The State of New Jersey and the U.S. Department of Agriculture (USDA) continued to provide the main sources of funding to NJAES through appropriations and sponsored research. State and Federal appropriations remained level at nearly $21 million and $7.4 million, respectively. Over the last 11 years, there has been a steady decline of state appropriation support for NJAES. As an increasing portion of the state appropriation to NJAES has necessarily been dedicated to fixed and rising salaries, residual operating funds have declined to zero, meaning that any operating funds must come from other resources.
Sponsored research grants and contracts support in fiscal year 2016 totaled $44 million, an increase of $3.1 million in comparison to the prior fiscal year and represented 46% of NJAES’ total funding.

State appropriation support declined to 21.9% of total funding, while federal appropriation support represented 7.8% of total funding in FY 2016. Income from royalties and other similar sources constituted 18% of total NJAES funding in FY 2016, and county appropriations contributed 6.2%.

Of the $17.6 million of federal support in research grants and contracts, USDA provided funding of $8.4 million in fiscal year 2016 compared to $7.9 million in the prior year. The State of New Jersey provided $12.4 million, up 10.6% from FY 2015, reflecting increases to several programs.

Foundation support increased by 36.6% in FY 2016, from $6.8 million in FY 2015 to $9.3 million. This increase is attributed to the new Stavros Niarchos Foundation planning grant, which is a partnership with Rutgers, The State University of New Jersey, in collaboration with the Agricultural University of Athens and the American Farm School. Support to NJAES from corporations decreased slightly in FY 2016 to $4.8 million, from $4.9 million in FY 2015.

Remaining sponsored research funding continues to support NJAES mission-oriented programs, including plant biology and pathology research; animal sciences; environmental sciences; transformational initiatives across many disciplines impacting food, nutrition, and health; continuing professional education programs; and the IR-4 Project.
Commercial Agriculture

Rutgers' statewide impact in its 250th anniversary year was proudly on display through the work of NJAES and RCE. The spotlight on Rutgers 250 All-Star Varieties—a yearlong celebration of NJAES breeding programs—reinforced the value of Rutgers' research to New Jersey agriculture. And Rutgers Cooperative Extension's 4-H Youth Development Program reached ever deeper into New Jersey's county fairs, sharing Rutgers' historic beginnings and highlighting the valuable role of RCE in local communities throughout the Garden State.

Robert M. Goodman
Executive Director, NJAES

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Celebrating ‘Rutgers 250’ with NJAES All-Star Varieties

In 1900, plant breeding began at NJAES in the Department of Horticulture, creating many new varieties of vegetables and distributing large quantities of seeds to farmers. The breeding programs that have since developed and continued into the next century include: cranberry, strawberry, tree fruit, hazelnut, basil, tomato, asparagus, oyster, exotic pepper, lettuce, turfgrass, holly, and dogwood.

In celebration of Rutgers’ 250th anniversary, NJAES showcased an all-star variety from each of its current plant and shellfish breeding programs. The Rutgers 250 NJAES All-Star Lineup includes: Scarlet Knight® Cranberry, ‘Portia Orton’ Holly Tree, Rutgers Scarlet Lettuce™, Downy mildew-resistant Sweet Basil, ‘NJ1113’ Asparagus, Rutgers 250™ Tomato, Rutgers Scarlet™ Strawberry, ‘Rutpink’ Scarlet Fire™ Dogwood Tree, ‘NJF16’ TangOs® Peach, ‘Triploid’ Oyster, Blue Note Kentucky Bluegrass, Eastern Filbert Blight-resistant Hazelnut, and Pumpkin Habañero Pepper. The Rutgers 250: All Star Varieties website (breeding.rutgers.edu) provides information about the breeding programs and the availability of these plant and shellfish products, along with news coverage for these items.

These varieties were selected for desirable traits, such as increased yields, improved disease resistance, stress tolerance, improved flavor, enhanced nutritional content, and superior overall quality. Efforts made by NJAES breeding programs assist farmers in adapting to environmental and economic changes. Cultivars are selected for quality, yield, and resistance to diseases of local importance. Other goals of this research include preparation for climate change through heat and drought tolerance and cold hardiness. Many of the research trials take place on New Jersey commercial farms, a long-time practice of the experiment station. Rutgers plant and shellfish researchers develop and evaluate varieties for New Jersey and the region. Varieties bred at NJAES research centers across the state have been developed using traditional breeding techniques, enhanced with advanced analytical tools in selection and evaluation (sensory, nutritional, and disease and pest resistance).

On November 4 this year, NJAES hosted a Rutgers 250 Breeding Celebration and Luncheon in honor of the university’s anniversary. The five-course menu featured the Rutgers 250 All-Star Varieties of plants and shellfish. Speakers included Rutgers breeders who provided insight on the development of new varieties, such as downy mildew-resistant basil and Eastern Filbert Blight-resistant hazelnut trees. Speakers also included New Jersey Secretary of Agriculture Doug Fisher as well as New Jersey food industry entrepreneurs. Sponsors for the event included several agriculture and food companies that work with and sell products based on Rutgers varieties. The event served as an opportunity to celebrate decades of revolutionary research, promote NJAES breeding programs, and bring together agricultural stakeholders.
USDA Grant to Promote Ultra-Niche Crops Supports Beginning Farmers in New Jersey

To address the changing face of agriculture in New Jersey, team members from Rutgers NJAES Cooperative Extension secured a $460,170 grant under the Beginning Farmer and Rancher Development Program. This three-year grant, administered by USDA’s National Institute of Food and Agriculture (NIFA), funds the Rutgers Ultra-Niche Crops Project that will teach new and beginning farmers—virtually and in-person—about the cultivation, marketing, and business management of farming 10 “ultra-niche” crops, including strawberries, cut flowers, high-tunnel lettuce, and specialty peppers. “Ultra-niche” is conceived as exceptionally high-value crops that can provide a significant source of income to the farmer while using minimal land.

The goal is to aid beginning farmers to grow crops that will help them make more money from less land, leading to the development of successful, small-scale enterprises that ultimately promote and encourage sustainability for the next generation of food producers.

The team has developed exciting, cutting-edge delivery methods that beginning farmers have indicated are important to their efforts, like “virtual field trips,” which are condensed videos showing the crop growing on the farm that include interviews with a farmer, a buyer, and a researcher. To cut down on travel time for participants in the project, classes will be offered simultaneously at three sites throughout the state using industry-standard broadcast software.

Educational programming will include crop selection strategies and business training, plus marketing techniques. Through the project, farmers will be able to evaluate whether or not a specific crop would work for their operation. Farmers will have access to a series of video fact sheets, virtual field trips, crop profiles with budgets, and food safety worksheets that will be available online through the university.

The Rutgers Ultra-Niche Crops Project team is led by Jenny Carleo, Cape May County agent. The team also consists of Robin Brumfield, extension specialist in farm management; Hemant Gohil, Gloucester County agent; Ramu Govindasamy, extension specialist in farm management; Jeff Heckman, Rutgers NJAES Media Productions; Dan Kluchinski, chair of the Department of Agriculture and Natural Resources; Jennifer Matthews, project coordinator; Meredith Melendez, Mercer County agent; Pete Nitzsche, Morris County agent; Nick Polanin, Somerset County agent; Jim Simon, distinguished professor in the Department of Plant Biology; and Andy Wyenandt, extension specialist in vegetable pathology.

The team is supported by an advisory council consisting of 11 farmers and agricultural service providers including members of Farm Credit East, the New Jersey Agricultural Society, Zone 7, and the New Jersey Farm Bureau. Visit njaes.rutgers.edu/ultra-niche-crops.
Distance Education for Empowering Women in Agriculture

Annie’s Project is a national agricultural risk management program for women farmers that emphasizes five areas of risk (production, legal, human, financial, and marketing) and creates support networks for women in agriculture. While each state presents challenges unique to their location, Annie’s Project has been successfully adapted across the U.S.

Before launching Annie’s Project in New Jersey, the program delivery team held focus groups with women farmers to identify and overcome several challenges. These included a small educational team, lack of time for “traditional” classroom workshops, and poor understanding of estate planning principles.

Solutions to these problems included implementing multiple synchronous classes, one-day workshops, webinars, on-line video recorded classes for asynchronous learning, and three day-long workshops focused on estate planning, titled Preparing for Later Life Farming, since most farmers don’t choose to retire completely. Modifications to the basic curriculum included shorter sessions, urban agriculture and direct marketing topics, the use of online technology and social media, an extended course focused on greenhouse production, and international collaborations to expand program reach and impact throughout New Jersey and beyond.

In May, a one-day workshop in Bridgewater, NJ, “Empowering Women in Agriculture Though Business Management Training (EMWOFA)”, was funded via a European Union Erasmus+ grant. Additional funding from the John and Anne Gerwig Director’s Fund for Rutgers Cooperative Extension enabled the Annie’s Project team to digitally record the presentations and discussion and post them online at the Rutgers Farm Management website: farmmgmt.rutgers.edu, allowing repeated on-demand or asynchronous learning that is not available in a typical workshop. International partners in attendance from Germany, Turkey, Greece, Spain, and Malta are expected to adopt some of the materials in their home countries. The team also expects at least 50% of local attendees to either launch or amend their current social media outlets to include topics and issues that were covered as part of the presentations, and to have enhanced knowledge and appreciation of the areas of risk presented in the session.

Communication with agricultural producers has been vital in developing programming that is relevant to their needs. This diligence has resulted in national awards and international professional publications. Demonstrating that the Annie’s Project program can be modified to address learning needs that are unique to a specific location, educators around the country and the globe can use these ideas to better serve women farmers.
Release of ‘Rutgers 250’ Tomato and Specialty Crop Grant for High Tunnel Urban Gardens

The Rutgers tomato was a leading home garden and processing variety in the 20th century that is still popular among home gardeners today. Developed by Rutgers vegetable breeder Lyman Schermerhorn, the original cross was made at the Campbell Soup Company in 1928, with leading processing tomatoes as the parent varieties.

In cooperation with Campbell’s, Schermerhorn advanced the cross and conducted field tests on New Jersey farms until 1934, when it was released as the Rutgers tomato. The tomato was the preferred choice of commercial growers through much of the mid-20th century.

Decades later, the original Rutgers tomato line was not preserved, and the seeds sold today are derivatives. As a result, Rutgers vegetable researchers sought to re-create the original strain. This was made possible when Rutgers professor of plant breeding Tom Orton, Morris County agricultural agent Pete Nitzsche, and associate director of NJAES farm programs Jack Rabin received seeds of parent varieties for the Rutgers tomato from Campbell’s Soup in 2010. The means to recreate the “original” Rutgers tomato became a reality. The release in spring of 2016 coincided with Rutgers’ 250th anniversary, thus the re-invented tomato was dubbed the “Rutgers 250” tomato.

To provide gardeners with this retro tomato, Rutgers 250 seeds were available from the university while tomato plants were sold by New Jersey commercial growers and Rutgers Master Gardeners.

Another boost to the Garden State is cultivating gardens for urban food production. In densely urbanized city centers, access to fresh, nutritious foods may be limited. Supermarkets are often located beyond walking distance and small grocery stores typically sell a limited selection of fresh fruits and vegetables. As a result, people living in city centers often consume low-quality food that can have a long-term impact on their health and the proper development of children. To address this challenge, funding from a USDA block grant was used to construct a high tunnel on a formerly abandoned property, now managed by the East Orange YMCA. High tunnels are a simple, relatively inexpensive, and effective way of protecting crops from marginal low temperatures, wind, rain, some insect and disease pests, as well as wildlife damage. In addition to adjacent raised beds, the high tunnel will be used to grow produce for distribution to local families and as a teaching tool for local families to grow food in their urban neighborhood.

The project is a partnership among the New Jersey Farm Bureau, the East Orange YMCA, and Rutgers Cooperative Extension. Construction of the high tunnel was realized with help from military veterans that participate in the Rutgers VETS program.
Environment and Natural Resources

During Rutgers’ 250th anniversary year, as we have celebrated the best of our history, we have taken pride in the many benefits we have provided to Garden State residents over the years through the New Jersey Agricultural Experiment Station. The research-based services of NJAES have improved the environment, helped manage our water resources, supported farmers and families, inspired young people, and enriched local communities. My thanks to all who have added to the experiment station’s proud tradition this year.

Robert L. Barchi
President, Rutgers University

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The Center for Resilient Landscapes

The Center for Resilient Landscapes (CRL) is a new collaborative research effort of the Rutgers School of Environmental and Biological Sciences, the New Jersey Agricultural Experiment Station, and the USDA Forest Service Northern Research Station. The objective of the center is to focus on the development of social-ecological system resilience—from short-term recovery to longer-term restoration—and fundamental system re-organization or resilience. CRL personnel are studying and supporting improved stewardship of urban and rural natural resources and their linkages to enhanced community wellbeing, public attitudes and behaviors, and sound policymaking.

Initial research emphases of the center include:

1) Understanding resilience within complex landscapes under conditions of global change, periodic disturbance, and urbanization;

2) Evaluating strategies for increasing socio-ecological resilience; and

3) Designing scientifically informed tools to facilitate state and community responses to natural disturbances and extreme events.

To further this effort, the center is funding post-doctoral research to develop an applied socio-ecological simulation model of governance and ecological processes to address current and future challenges in forest resilience in the face of changing human development and climate regimes. This line of research is focused on the study of disturbance regimes prevalent in New Jersey and the surrounding region. The current application for this model is the spread of emerald ash borer in New Jersey, but the model is designed to be adjusted to any disturbance, including fire in the wildland-urban interface, extreme storm events, developmental pressures, pests and invasive species, and changing economies and markets.

In addition, the center is currently supporting four fellowships that serve research projects through the USDA Forest Service Philadelphia Field Station, the New York City Urban Field Station, and the Silas Little Experimental Forest in New Jersey. The four research projects include a study of forest fragments in urbanized areas, a long-term analysis on the effects of emerald ash borer, the development of a new technique to estimate surface fuel loads for forest fire management, and an understanding of how an ecological restoration experiment can be a catalyst for new forms of civic engagement.

Since its establishment in 2014, the Center for Resilient Landscapes has been highly successful in creating opportunities for collaborative research and growing a network of cooperation, exchange, and expertise. The development of the center has led to several joint Rutgers and Forest Service training opportunities for graduate, doctoral, and post-doctoral researchers in projects that would have been difficult, if not impossible, to undertake without this partnership and sharing of resources.
Research Vessel Widens Research Opportunities on Raritan River

The Rutgers Collaborative for Raritan Education & Outreach (RCREO) will facilitate use of the Raritan Basin as an interactive field laboratory and will enhance research opportunities by linking science, engineering, and humanities programs through interdisciplinary projects and activities that take place on and in the “Old Raritan”, its tributaries, and throughout the estuary.

This will be accomplished by developing a physical, cyber, and social infrastructure that will connect Rutgers and the New Jersey Agriculture Experiment Station (NJAES) with the broader stakeholder community on and in the river, using boats and autonomous vehicles. These platforms will enable collection and analysis of data about the river basin, and new partnerships to easily share these data with others. The ultimate goal of RCREO is to create an interactive field laboratory that supports a research network to study the evolving status of the Raritan in a highly urbanized setting.

Among the first actions taken by the RCREO was the acquisition of a dedicated vessel laboratory to anchor this initiative. The 20-passenger landing craft can navigate the river and estuary, providing firsthand access to researchers throughout the Raritan ecosystem. The new vessel provides a research platform that will not only support scientific exploration of the physical and biological riverine ecosystem, but will also enable field experiences relevant for the social sciences and humanities, including the social or historical role of the Raritan for New Jersey and the region. Internal and external NJAES stakeholders who are interested in exploring the Raritan can make arrangements to use the vessel, which is conveniently accessed at the Rutgers Class of 1914 Boathouse on the New Brunswick Campus.

In addition to providing field experiences, the RCREO is working to connect Rutgers and the broader stakeholder community to the Raritan River through networks and online resources. The RCREO is developing a group within the Rutgers community who are interested in using the data collected on the Raritan for research and/or teaching purposes. This group will share resources, including effective teaching practices and activities, as well as discussing relevant research questions.

RCREO has also worked with the Sustainable Raritan River Initiative on the development of the Rutgers Raritan River Consortium, a universitywide effort aimed at supporting education, research, and scholarship as well as collaborating with other Raritan partners to advance improvements in regional planning, policy, and decision-making.

The Raritan provides a diverse landscape with a variety of local ecosystems modified by human intervention over hundreds of years. The RCREO will provide the opportunity for faculty, students, and the broader stakeholder community to access this dynamic environment in person or virtually, and promote dialogue and collaboration among a wide range of NJAES activities.
Rutgers Air Pollution Training Program and the Noise Technical Assistance Center

The Rutgers Air Pollution Training Program (RAPTP) was founded in the 1950s by the late Raymond M. Manganelli, professor in the Department of Environmental Sciences. Members of both the regulated and regulatory communities attend courses at RAPTP. It especially serves as an important training provider to NJDEP, which provides annual grant funding, and to county environmental health agencies. One course, conducted in the horse pasture along College Farm Road, has been a curiosity for the George H. Cook Campus community for over 50 years. Each spring and fall, a blue machine pumps out smoke for a crowd of onlookers seated on lawn chairs. The course is officially titled, “Visible Emissions Evaluation,” but it is commonly called “smoke school.” The course teaches and certifies governmental and private sector personnel to “read” smoke. The denser the emissions from a facility’s stack, the poorer the combustion efficiency and the more pollutants emitted to the environment. This concept, around since the 19th century, is a powerful compliance tool that requires no instruments—only the trained eye—to ensure a facility is operating in compliance with regulations. Other courses offered by RAPTP include Stack Sampling, Ambient Air Monitoring, Odor Field Enforcement, Principles and Practices of Air Pollution Control, and Control of Particulate and Gaseous Emissions. Since 1991, Stephen Szulecki has been the primary instructor and director of RAPTP. Professor Peter Strom from the Department of Environmental Sciences serves as principal investigator and Ron Lauck as administrative assistant of RAPTP.

The Rutgers Noise Technical Assistance Center (RNTAC) has been training noise investigators, conducting research, and providing technical assistance to governmental agencies, industrial clients, and residents since the 1970s. As part of the Air and Noise Training Program in the Department of Environmental Sciences, the RNTAC trains and certifies enforcement personnel in New Jersey pursuant to state law, and conducts courses across the U.S. and internationally. Trainees represent regulatory agencies; police; health, code, zoning, and law officials, industrial clients, consultants, and New Jersey residents. The training emphasizes the technology, techniques, and strategies of conducting sound level measurements to evaluate regulatory compliance and, if appropriate, proceed to enforcement and prosecution. The investigator must be able to quantify the sound levels of the source under investigation, in a complex acoustical environment that may also include an adjacent highway, aircraft, or similar facilities to the one under investigation. The field data collected from investigations must be able to withstand legal scrutiny. For the past 25 years, RNTAC has operated under the direction of Eric Zwerling, Department of Environmental Sciences, who conducts the training and the research, regularly published in journals. Municipalities throughout New Jersey have adopted the noise ordinance promulgated through NJAES’ noise enforcement publication. The RNTAC conducted a three-year $300,000 community noise exposure assessment study for the EPA on train noise in Teaneck, NJ. Recently, the center has assisted the New Jersey State Agricultural Development Committee in developing noise regulations for photovoltaic and wind turbine installations on preserved farmlands, which led to the adoption of new rules. The RNTAC participates in the New Jersey Noise Control Council, an advisory body to the New Jersey Department of Environmental Protection, and serves to address topical issues and provide long-term solutions such as interpreting and amending the state noise code.
Stormwater Management and Green Infrastructure Projects for New Jersey Municipalities

The mission of the Rutgers Cooperative Extension (RCE) Water Resources Program has been to identify and address community water resources issues using sustainable and practical science-based solutions. Since it was established in 2002, this award-winning, statewide program has focused on agricultural water management, stormwater management and green infrastructure, and watershed planning and restoration.

Over the past several years, the program has developed comprehensive plans for regional stormwater management and watershed restoration for small watersheds (20–50 square miles) throughout New Jersey. These plans are both labor- and cost-intensive due to the extensive hydrologic, hydraulic, and pollutant modeling required and the surface water sampling needed to validate these models.

Created and led by Christopher Obropta, extension specialist in water resources in the Department of Environmental Sciences, the program has adopted a new planning format focusing on identifying opportunities for implementing green infrastructure practices to better manage stormwater runoff.

What is green infrastructure? With respect to stormwater management, green infrastructure is a small-scale approach that addresses runoff near its source and is cost effective, sustainable, and environmentally friendly. Green infrastructure practices use soil and vegetation to recycle stormwater runoff through infiltration and evapotranspiration. When used as components of a stormwater management system, green infrastructure practices such as bioretention, green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these technologies can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits.

This new planning format consists of completing impervious cover assessments (ICA) and then developing impervious cover reduction action plans (RAP) for municipalities. Digital imagery is used to identify opportunities for implementing green infrastructure practices, and field investigations are conducted to determine the best practice for each identified site. The ICA and RAP cost about 10% of the price needed to develop regional and watershed restoration plans and only take a couple of months to complete. These two documents together provide a blueprint for municipalities to move forward with stormwater management projects that will improve water quality, reduce flooding, and enhance climate resiliency.

So far, the RCE Water Resources Program has completed ICAs and RAPs for over 62 municipalities, with the ultimate goal of serving every municipality in New Jersey. For the 54 municipalities that have been completed in the Raritan River Watershed, 897 sites have been identified for green infrastructure practices and 45 projects have been constructed so far. Support has been provided by the National Fish and Wildlife Foundation, New Jersey Sea Grant, the William Penn Foundation, and the Geraldine R. Dodge Foundation.
Richard L. Edwards
Chancellor, Rutgers University—New Brunswick

Rutgers’ proud 250-year history of world-class academic achievements of our faculty and students is complemented by the statewide reach of outstanding NJAES science-based educational programs. From our commitment to maintaining Garden State leadership in production agriculture & fisheries to innovative youth development activities and critical partnerships to address areas of real need like food access and security, NJAES plays a vital role in the wellbeing of New Jersey’s diverse communities. Rutgers, Revolutionary for another 250 years.
Surveying Fish Species and Studying Shifts in Fisheries Due to Climate Change

Several of New Jersey’s most important fish species for commercial and recreational fishermen inhabit rocky reefs, shipwrecks, and artificial reefs. These “structure-associated” species, like black sea bass and tautog, present a special challenge for management because they aren’t easily surveyed by the most common scientific survey gear such as a trawl net towed behind a boat. Trawl survey vessels must avoid wrecks and reefs or risk getting caught on the bottom. Concerns about the use of trawl survey data for black sea bass have led managers to treat it as a “data-poor” species that requires precautionary reductions in catch to avoid overfishing.

Rutgers fishery scientists Eleanor Bochenek and Olaf Jensen, in collaboration with colleagues at the University of Maryland and the University of North Carolina, are developing two new methods of surveying structure-associated species. The first method uses the same hook-and-line fishing gear used by recreational anglers. The gear is fished by volunteer fishermen from Rhode Island to North Carolina using a standardized protocol. The data will help determine whether life history characteristics, including growth and maturity rates, differ throughout the range of the population.

A second method uses commercial fish traps similar to lobster traps to study the species found on New Jersey’s artificial reefs. This research is funded by NOAA and NJDEP.

Recent collaborative research has focused on understanding how climate change and variability affect coastal marine animals and how these changes affect fisheries. Malin Pinsky, marine ecologist in the Department of Ecology, Evolution, and Natural Resources, leads a collaborative project funded by the National Science Foundation to study the rapid shifts in distribution for important fishery species, including hake and summer flounder—traditionally one of the most sought-after catches along the East Coast.

The collaborative team includes Bonnie McCoy, professor emerita of human ecology, Kevin St. Martin, associate professor of geography, plus researchers at Yale and Princeton universities.

The team has shown how these shifts affect wealth in the oceans and has documented boats traveling hundreds of miles further in order to continue catching summer flounder, which has seen a steady northward migration along the U.S. East Coast. The team is also beginning to document how shifts in species distribution ripple throughout food webs to affect other species.
Expanding Shellfish Aquaculture Offshore and Promoting Shellfish Restoration Efforts

Oyster aquaculture, especially the rack and bag production of eastern oysters (*Crassostrea virginica*), has been concentrated in intertidal areas of the lower Delaware Bay. In a recent project supported by a grant from the NOAA Saltonstall-Kennedy program, the Rutgers Haskin Shellfish Research Laboratory (HSRL) has collaborated with two industry partners to demonstrate and evaluate the commercial feasibility of subtidal oyster cage aquaculture in the bay. While such methods have been developed elsewhere, the unique characteristics of Delaware Bay—open water, strong currents, large ice flows—have precluded commercial investment in infrastructure that can demonstrate the technical capability and economic feasibility of such endeavors here in New Jersey. The joint, federally funded project is focused on expanding the fledgling offshore oyster aquaculture industry to grow and secure a viable and sustainable future. Developing offshore aquaculture also avoids interactions with threatened shore birds, like the federally listed red knot (*Calidris canutus rufa*) that uses the Cape Shore region of the bay where the majority of existing oyster farms in New Jersey are located, as an important stopover site on its migration from southern Argentina to breeding grounds in the Canadian Arctic.

Closer to shore, South Jersey school children have it “in the bag,” the shell bag, that is. Some 4,000 students from 25 schools, grades K–12, worked side-by-side with HSRL scientists to construct more than 15,000 shell bags that were used to create oyster reefs and bolster bayside shorelines decimated by Hurricane Sandy. HSRL has been engaging local youth in real-world oyster restoration work through its outreach program known as Project PORTS: Promoting Oyster Restoration Through Schools. Project PORTS, which celebrated its 10th anniversary in 2016, gets kids excited about science, the local environment, and environmental stewardship through a series of hands-on learning experiences focusing on Delaware Bay ecology. The shoreline enhancement project, which was led by The Nature Conservancy, was one of 31 projects awarded Hurricane Sandy Mitigation funds from the U.S. Department of the Interior. The Nature Conservancy-Rutgers partnership presented a great opportunity to add coastal resiliency to Project PORTS’ own robust educational activities.

The Barnegat Bay Shellfish Restoration Program (BBSRP), a cooperative environmental stewardship program fostered by Rutgers Cooperative Extension of Ocean County and the NJDEP Bureau of Shellfisheries, has completed 11 years of efforts to educate the public using hard clam, oyster, and bay scallops as a focal point. BBSRP and ReClam the Bay volunteers—graduates of the BBSRP Certified Shellfish Gardener classes—have worked with more than 15 million clam seed, 4.5 million single oysters, hundreds of thousands of oyster spat, and 100,000 bay scallop seed. The program volunteers provide outreach at schools, festivals, and demonstrations at upweller seed nurseries around the bay. Led by Rutgers Cooperative Extension marine extension agent Gef Flimlin, who retired at the end of 2016, the BBSRP program is poised for continued growth under the next marine extension agent.
Jacques Cousteau National Estuarine Research Reserve Assesses Coastal Vulnerability to Climate Change

The Tuckerton Peninsula is a 5,000-acre Spartina salt marsh system that separates the Barnegat Bay-Little Egg Harbor and Mullica River-Great Bay estuaries in New Jersey. It is also the designated “sentinel site” of the Jacques Cousteau National Estuarine Research Reserve (JCNERR) for the detection and monitoring of climate change effects, such as coastal habitat responses to sea level rise, major storms, and inundation. This site is part of a coastal network of sentinel sites established by NOAA’s National Estuarine Research Reserve Program in the Mid-Atlantic and other regions of the country to understand the short- and long-term trends in coastal marsh conditions locally, regionally, and nationally. One major goal is to assess the sustainability of the Tuckerton Peninsula salt marsh to climate change effects which will generate vital information for New Jersey’s coastal communities.

Marsh habitats are vitally important because they serve as protective buffers that reduce the vulnerability of coastal communities to sea level rise, storm surge, and flooding. It also provides an array of other ecosystem services including groundwater storage; contaminant filtration; biogeochemical cycling; carbon sequestration; habitat formation (for fish assemblages, bird populations, and other biota); and migratory pathways for shorebirds, horseshoe crabs, and other sensitive species that rely on the marsh system for survival.

The establishment of the JCNERR sentinel site as a long-term research and monitoring station supports NOAA’s mission to assess coastal vulnerability to climate change and generate the monitoring and research data useful for forging climate adaptation and mitigation plans for coastal communities that will increase their resilience, particularly in the aftermath of the sweeping coastal destruction from Superstorm Sandy. Monitoring infrastructure has been installed in the salt marsh platform for essential observational data acquisition.

The purpose of the sentinel site is to document changes in marsh accretion rates, marsh surface elevation, and intertidal/subtidal habitat of the Tuckerton Peninsula with ongoing climate change and land subsidence. To this end, biomonitoring surveys, marsh elevation and emergent vegetation mapping, and the acquisition of vegetation health metrics will be ongoing to characterize vital spatial-temporal changes in the marsh system. Together, current and future projects will leverage our understanding of climate change impacts on the peninsula and will help coastal managers plan effective adaptation strategies for future loss of this extensive marsh platform that currently buffers human settlement from extreme weather-related events, inundation, and flooding associated with rising sea level and coastal storm surge.

Technical assistance on community resilience planning and implementation is being provided to more than 60 coastal communities using state-of-the-art decision-support tools such as the NJ Floodmapper (slrviewer.rutgers.edu), NJADAPT (njadapt.org), and Getting to Resilience (prepareyourcommunitynj.org). Partners include the Bloustein School of Planning and Public Policy, the Grant F. Walton Center for Remote Sensing and Spatial Analysis, and the Rutgers Climate Institute.
Range of Valuable Research Conducted at Rutgers Aquaculture Field Stations

The Haskin Shellfish Research Laboratory (HSRL) has been breeding oysters for disease resistance since 1960 through both traditional selective breeding and modern breeding technologies. To understand the genetics of disease resistance, shellfish geneticist Ximing Guo and his team have developed new and pure lines of oysters that may prove to be valuable for studies on disease resistance. These oyster lines are produced by a novel procedure called gynogenesis, where oyster eggs are induced to develop without inclusion of sperm DNA. Oysters produced this way are genetically pure and valuable for genetic analyses. These pure-line oysters are particularly useful for mapping disease-resistance genes and for decoding the oyster genome because wild oysters contain too much genetic variation for sequencing assembly. One “lucky” oyster from these pure-lines has been selected for whole genome sequencing as part of a USDA-funded project to provide the reference genome for the eastern oyster.

While the NJ Aquaculture Innovation Center conducts research on oysters and hard clams (little necks, top necks, cherrystones, and chowders)—the primary shellfish cultured in New Jersey for decades—there is tremendous potential for many other species. Graduate student Mike Acquafredda is collaborating with HSRL scientist Daphne Munroe and aquaculture program coordinator Lisa Calvo to investigate and refine culture methods for surfclams (*Spisula solidissima*). Surfclams grow in large beds off the Atlantic Coast of New Jersey where large adults are harvested at 5–10 years of age to make clam strips and other food products. They are conducting temperature tolerance experiments on juvenile clams in the nursery and then tracking growth after the clams are planted on local farms. Initial results suggest the possibility of getting cultured clams to market in less than a year.

Shellfish aquaculture is one of the most environmentally friendly food production systems but it has come into conflict with bird enthusiasts in the Delaware Bay. For decades, oysters have been cultivated on large racks across the sand flats of Delaware Bay where, for a brief period in the late spring, migrating birds flock to gorge on eggs of horseshoe crabs spawning inshore of the oyster farms. In 1957, disease devastated the oysters, ending their cultivation. NJAES has bred disease-resistant oysters that have revived their cultivation, but as farms began to grow, horseshoe crabs and some birds have declined. Highly precautionary conservation measures in the bird migratory period now limit oyster farm operations and growth. Rutgers scientists are investigating how shore birds respond to oyster farms and whether or not the farms hinder horseshoe crab spawning, a major concern of shorebird conservationists and the U.S. Fish and Wildlife Service after listing the rufa red knot as threatened. Results will inform an adaptive management strategy designed to protect the birds while sustaining the viability of oyster farms.
Food, Nutrition, and Health

Douglas H. Fisher
New Jersey Secretary of Agriculture

The Rutgers New Jersey Agricultural Experiment Station continues to inform and bring innovation to the various sectors of the agricultural industry in the Garden State. Our partnership has evolved and expanded over the years to explore and address the numerous challenges and opportunities encountered by our farming community. Every day we recognize the importance of the services that NJAES provides as New Jersey agriculture strives to meet the needs of our local citizens and successfully compete in a global economy.
The Center for Digestive Health at the Institute for Food, Nutrition, and Health

The New Jersey Institute for Food, Nutrition, and Health (IFNH) on the George H. Cook Campus is home to the new Center for Digestive Health. This center draws upon the expertise and experience of faculty from across the university to work on various aspects of gastro-intestinal physiology and health. The gastro-intestinal tract is one of the major ecological niches for the over 100 trillion microorganisms that live within and on the human body. Scientists and medical professionals are just beginning to appreciate the major role the human microbiome plays in human health and disease. Not surprisingly, the gut microbiome is now viewed as an important therapeutic target for the management of a wide spectrum of human conditions, ranging from metabolic disorders like obesity to central nervous system disorders like depression.

To help researchers study the gut and its inhabitants, the center recently entered into a strategic partnership with ProDigest, a Belgium-based company located at Ghent University. This partnership has brought a state-of-the-art instrument called the SHIME® to the IFNH. The Simulator of Human Intestinal Microbial Ecosystem or SHIME® represents an advanced technological platform for studying microbial, physical, and chemical processes in the gut under controlled experimental conditions. The advanced computer control algorithms of the system allow investigators to study the complete gastro-intestinal tract. Notably, the control systems can be configured to model that of an infant or adult human. With this instrument, detailed biological processes can be explored in vitro as a prelude to human studies. Currently, there are only two SHIME® systems in the United States; one at the IFNH and one at the USDA's Eastern Regional Research Center in Philadelphia. Professor Michael Chikindas of the Department of Food Science is leading the SHIME® program at Rutgers and connecting it to the international research community.

The Center for Digestive Health and the institute’s new open-space laboratory have been an important factor in recruiting new faculty. In 2016, IFNH recruited two outstanding investigators, Diana Roopchand and Harini Sampath, as assistant professors with academic homes in the departments of Food Science and Nutritional Sciences, respectively. The new faculty members are quickly building their research teams and have already started to supervise graduate students and post-doctoral fellows. The institute will add two more investigators in 2017.

The Center for Digestive Health is one of four “centers of excellence” within the institute; the others include the Center for Lipid Research, the Center for Health and Human Performance, and the Center for Childhood Nutrition Education & Research. In keeping with the interdisciplinary culture of the institute, the centers are finding novel ways to work together and explore new frontiers at the interface of food science, nutrition science, kinesiology, and medicine.
Rutgers Cooperative Extension of Middlesex County sponsored a program in July at the EARTH Center in South Brunswick, NJ, called “Getting Healthy Food to Those in Need: A Symposium for Food Pantries and Soup Kitchens.” The program brought together organizations that provide fresh produce to those in need. This initiative was the result of a request from food pantry organizers who sought assistance in growing their own charitable gardens.

The first part of the program was a discussion of USDA programs, the New Jersey Expanded Food Nutrition Education Program (EFNEP) and the NJ Supplemental Nutrition Assistance Program-Education (SNAP-Ed). These two programs help limited-income adults, families, youth, and seniors improve their eating habits, reduce their risk of obesity, and make better use of their SNAP benefits and/or limited income.

The relationships between food sources and distributors were discussed by two groups that rely on volunteer efforts, the Farmers Against Hunger (FAH) division of the New Jersey Ag Society and MCFOODS, the county’s food bank. MCFOODS described how their program partners with FAH and the Community Food Bank of NJ to bring fresh produce to the 100 food pantries, soup kitchens, and social service agencies in their network. Farmers Against Hunger discussed the need for increased “on-call” volunteer support for opportunities to harvest surplus produce at statewide gleaning events. Gleanings take place at local farms as crops become available for donation, with FAH scheduling individuals and teams to help with the harvest. This surplus fresh produce is donated directly to local food pantries. Most often, the produce from the fields makes it to a recipient’s table within 12–24 hours.

The program also focused on efforts by local food pantries to create community gardens to increase access to fresh produce. A visit to the demonstration gardens at the Middlesex County EARTH Center provided tips for organizations looking to start a community garden and donate their produce to those in need.

Local volunteers and organizers from smaller organizations were also on hand to learn about regional efforts to make fresh food accessible. Discussions and feedback from participants provided the framework for the dialogue on current challenges faced by these organizations. Bill Hlubik, Middlesex County agent, discussed the Rutgers Against Hunger program and how it has become a successful universitywide effort to help alleviate hunger through donations and organized gleaning programs.

Symposium participants, which included representatives from local churches, and food banks and pantries as well as members of the United Way, were seeking to improve the productivity of their organization’s “Gardens for the Hungry.”
Worldwide Movement of Über-Mosquitoes and Implications for Public Health

Viruses transmitted by mosquitoes (arboviruses) represent a major threat to public health worldwide. The re-emergence of dengue and dengue hemorrhagic fever was recognized in 2015 as a major concern by the World Health Organization (WHO), with more than 40% of the world’s population at risk and estimates of more than 300 million infections and thousands of deaths every year. There have been recent outbreaks of chikungunya in islands in the Indian Ocean, as well as in India, Europe, and the Americas, with more than one million known cases to date.

Since January 2016, Latin America and the Caribbean have experienced a major outbreak of Zika virus and WHO has declared a global emergency, as it did for the Ebola virus, because Zika infection in the unborn fetus can result in lifelong disability. The Zika emergency was recently lifted only because of the unfortunate reality that Zika is now well established in the New World and no longer containable.

All of these arbovirus epidemics are driven by just a few worldwide invasive species of mosquitoes, primarily in the genus *Aedes*. Unfortunately, following years of intensive usage, resistance of *Aedes* mosquitoes to chemical insecticides has dramatically increased. Describing and predicting the unabated movement of mosquitoes across the world has been a research theme throughout the career of Dina Fonseca, professor in the Department of Entomology and director of the Center for Vector Biology. She and her team at Rutgers have recently started working on better strategies to identify, standardize, and monitor insecticide resistance in mosquitoes. They produced the first reference strain for the Asian tiger mosquito from specimens collected in New Jersey in 1995, the first year the species was collected here. Fonseca and her team donated the reference strain to the Biodefense and Emerging Infections Research Resources Repository, where it is available at no cost. This is vital scientific and public health research, as the pervasive worldwide movement of insecticide-resistant mosquitoes is recognized as the primary barrier to dengue and Zika control, feeding the re-emergence of other mosquito-transmitted diseases.

Resistance of mosquitoes to insecticides can be a consequence of mutations in genes encoding for the proteins targeted by the insecticide, lower penetration or sequestration of the insecticide, or an increased biodegradation of the insecticide due to accelerated detoxification. The development of next-generation sequencing and targeted nucleic acid capture is poised to revolutionize epidemiology. Championed for research on invasive mosquitoes by Fonseca and her Rutgers team, this technique allows the simultaneous detection of insecticide resistance and its source. By examining populations obtained from the Worldwide Insecticide resistance Network (WIN)—of which Rutgers is a founding member—the Rutgers researchers will identify new genes under strong selection, such as new candidates for insecticide resistance, while recovering worldwide pathways of movement of arboviral vectors.
Creating a Culture of Health for New Jersey Communities

The Department of Family and Community Health Sciences (FCHS) is an active partner in creating and building healthy communities. Its community-based innovative approaches, facilitated by a team of dedicated FCHS educators, are improving health and building a “Culture of Health for New Jersey Communities” by increasing food access, advancing health equities, and improving health for youth and adults.

In the city of Trenton, Mercer County, Michelle Brill participates in the popular Greenwood Avenue Farmers Market, which increases access to healthy food options in a previously underserved neighborhood. The Greenwood Farmers Market is now in its second year of operation. In Somerset County, Daryl Minch is part of a Healthier Somerset - Building a Culture of Health grant for 2016–2020, while three FCHS educators have NJ Health Initiative grants funding work in Healthy Corner Stores in Passaic, Elizabeth, and in Mercer County. FCHS educators Sandra Grenci, Michelle Brill, and Shailja Mathur have completed the “Evidence-based Chronic Disease-Self-Management Program,” reaching 156 participants who are identifying self-management skills for their chronic disease.

In Hunterdon County, Sandra Grenci is participating in one of seven national teams engaged in the Bristol-Myers Squib-Morehouse School of Medicine Partnership for Diabetes Health Equity Learning Collaborative working to advance health equities. With childhood obesity a concern, Marilou Rochford in Cape May has developed a cooking camp for youth to address some of the health concerns using hands-on food preparation to encourage a lifetime of healthy eating. Rachel Tansey and Sharese Porter have provided similar cooking programs for youth in Belmar.

Sherri Cirignano in Warren County has worked with restaurants in her local community to increase healthy menu options. To date, eight restaurants are participating and have a total of 22 approved items that were determined through nutrition analysis. Educator Sara Elnakib has played a significant role in working with the Passaic Health Department and drafting a staple food ordinance to require all small food retailers to stock healthy food options such as low-fat dairy and low-sodium canned or dried beans. In addition, there will be a Food Hub Summit for the food businesses in the City of Paterson and the rest of Passaic County focusing on healthy and culturally specific foods as untapped markets for the food business communities.

Union County’s Spring Garden Conference, “Get Your Vegetable Garden Growing: Home—School—Community,” with Karen Ensle, and Gloucester County’s Grow Healthy Teacher Institute with Luanne Hughes, were developed to strengthen teachers’ academic curricula and build leadership with school and community leaders in the fields of wellness and edible education. More than 640 teachers have participated in FCHS professional development programs, reporting increased confidence, skills, and abilities to use gardens and food as educational tools across the elementary curriculum. Under the guidance of Alex DelCollo, Salem County had its first Summer Feeding Program for Youth. Joanne Kinsey has brought a Culture of Health full circle with Worksite Wellness Programs, a great model for New Jersey.
Much of the research at NJAES is performed in facilities on the George H. Cook Campus in New Brunswick, but our outlying research stations are critically important to enhancing the scope and impact of NJAES research. Farm-based stations around the state provide our scientists with a diversity of soil and microclimate environments, while coastal facilities afford access for aquaculture, fishery, and environmental research.
Professional Golf Turf Management School

The Rutgers Professional Golf Turf Management School, part of the Office of Continuing Professional Education, is a world-class learning center that has trained more than 5,000 successful greenskeepers in the art and science of golf course and turf management. School alumni represent all 50 states, 18 countries, and 6 continents as industry leaders working to improve top golf courses and sports stadiums worldwide. Founded in 1962 by Ralph Engel, a respected extension specialist, the school provides a creative learning environment where golf course employees can build their skills and knowledge in the ever-changing science of golf turf management. Engel believed in mentoring first, encouragement second, and, finally, exposure to the finest educators. The school continues to honor Engel’s vision with an instructional team drawn from distinguished Rutgers faculty and researchers as well as acclaimed industry experts and golf course superintendents who teach in two programs: a three-week preparatory short course and a two-year certificate program.

The three-week course covers the essentials of turfgrass management concepts and science in a condensed format every January. It is designed to help experienced greenskeepers get the formal education they need; to introduce new students to the field of turf management; to enable golf course owners and general managers to understand the fundamentals so they can better communicate with and manage their teams; and to help industry sales representatives to better understand the wants, needs, and terminology of their clients.

In partnership with the Rutgers Center for Turfgrass Science, the premier two-year program is geared toward seasoned professionals who are serious about advancing their careers through in-depth education. It consists of two ten-week sessions on campus in the fall or winter, sandwiched around a nine-month break during which students complete a 200+ hour paid internship. With students attending from all corners of the globe, the schedule was intentionally designed to maximize their time at Rutgers while minimizing time away from home and work. Through interactive classroom lectures, hands-on field training, and real-world experience via internships, students develop practical knowledge and skills to achieve their career goals.

Both programs cover technical topics that are essential for existing and aspiring turf managers, including plant physiology, turfgrass identification, pest management, disease and weed identification, soil fertility, landscape design, mower technology, irrigation, and more. Since future industry leaders need more than just plant knowledge, the two-year program also covers effective business communication, budgeting, management, and leadership.

In 2016, alumni from the Professional Golf Turf Management School worked at such prestigious events as the PGA Championship held at Baltusrol Golf Club in Springfield, NJ, the U.S. Open held at Oakmont Country Club in Oakmont, PA, and the Masters held at Augusta National Golf Club in Augusta, GA. Visit golfturf.rutgers.edu.
Rutgers Master Gardeners Focus on Volunteer Initiatives in New Jersey Counties

Rutgers Master Gardeners are trained volunteers who assist Rutgers Cooperative Extension in its mission to deliver horticultural programs and information to the general public. In addition to class instruction, Rutgers Master Gardeners are required to volunteer in their communities, helping to grow the “garden” in the Garden State.

In Cape May County, Rutgers Master Gardeners are making a difference by growing fresh vegetables for those in need. Volunteers planted over 1,600 plants in June at the “People’s Garden” located on the grounds of the USDA Plant Material Center, Natural Resources Conservation Service. Three local food pantries benefit from the “People’s Garden.” The garden operates at minimal cost, since the garden seeds had been saved from the previous season’s plants, and the planting and follow-up work is done by volunteers. In one season, volunteers planted 200 plants, yielding 160 pounds of vegetables donated to food pantries. The non-profit organizations that receive the vegetables help with weeding and harvesting their own vegetables, which are weighed as they leave.

In 2015, Rutgers Master Gardeners of Camden County partnered with the Camden County Community Greenhouse to grow flowers for the Camden County parks system. The three main annuals, petunias, verbena, and lantana, were selected for their drought tolerance, ease of care, and colorful displays. These plants generally grow horizontally and successfully fill in large spaces, while their vibrant colors catch the eye. The Camden County Community Greenhouse creates a unique learning experience for Rutgers Master Gardeners and “certified community greenhouse members” alike in learning what it takes to create live plant material. Full-grown plants are later placed in Camden County parks for the entire community to enjoy. With the goal of growing more sustainable plants for Camden County parks, the greenhouse is working on design ideas that feature perennial plants offering four seasons of color.

In Sussex County, Rutgers Master Gardeners partner with Project Self-Sufficiency’s Little Sprouts Early Learning Center, working hands-on in two garden beds dedicated to the preschool’s program. Through activities, stories, and interactive programming, the children learn to plant, grow, harvest, and eat from the garden. Combining storytime with garden maintenance tasks, the summer “Weed and Read” program offers young gardeners the experience of nurturing their own garden, patiently waiting for the plants to grow, and witnessing the changes over the season. At harvest time, the children eagerly reap the reward of their efforts and celebrate with a mini-feast of snacks from their own garden plot. Mentoring community volunteers and agency clients in the remaining 36 onsite garden beds, Rutgers Master Gardeners teach while growing more than 14 varieties of vegetables, herbs, fruit, and pollinator plants, providing all of the bounty to Sussex County families and individuals in need.
Rutgers Center for Turfgrass Science Marks 25th Anniversary

From its beginnings in the 1920s, the Rutgers Turfgrass Program has become one of the top research, teaching, and outreach programs in the world. The Rutgers Center for Turfgrass Science was established 25 years ago with the goal of conducting nationally recognized research, teaching, and service programs in support of the turfgrass industry, which is valued at more than $3.2 billion dollars in New Jersey and over $60 billion dollars in the U.S. The focus of the Turf Center is on cultivar development and turfgrass management.

The Rutgers turfgrass breeding program has the largest collection of cool-season turfgrasses in the world. This includes Kentucky bluegrass, bentgrass, tall fescue, fine fescue, and perennial ryegrass varieties that are used extensively on home lawns, golf courses, and athletic fields. With hundreds of cool-season turfgrass varieties released over the past 50 years, more than half of all premium turfgrass seed sold in the U.S. today originates from the Rutgers program. William Meyer, director of this program, was recently named the first C. Reed Funk Endowed Faculty Scholar in Plant Biology and Genetics in honor of late professor emeritus C. Reed Funk, a pioneer in turfgrass science who established the turfgrass breeding program at Rutgers in 1962. From the White House to your house, Rutgers varieties are used to provide natural playing surfaces on home lawns, as well as some of the most prestigious sports venues in the world, including many Super Bowl and college bowl fields; the Masters, US Open, and PGA Golf Tournament venues; the 2020 Tokyo Olympics; and numerous Major League Baseball stadiums throughout North America.

The university’s turfgrass program has strong international linkages, with extensive collaborations throughout Europe, Asia, and the Americas. Faculty from the center travel the world to collect new sources of cool-season grasses that have led to major breakthroughs, including the development of turfgrass varieties that use less fertilizer and water, and have dramatic improvements in pest and stress resistance. In addition, faculty are conducting cutting-edge research and outreach programs at the forefront of plant pathology, entomology, turfgrass management, soil and weed science, plant physiology, and evolutionary biology, resulting in novel and improved practices that suppress major turfgrass pests while reducing pesticide usage. They also work with state legislators and watershed associations to protect our water resources by providing science-based solutions to nutrient and pesticide management problems.

The Rutgers Turfgrass Program is also at the forefront of DNA sequencing technology, using molecular markers to identify genes that occur naturally in grasses for enhanced pest and stress tolerance. This is where many of the future advances are likely to come and an area in which Rutgers continues to enhance its global visibility and reputation in turfgrass science.
Plant Diagnostic and Soil Testing Laboratory Services

Soil testing and plant diagnostic services are provided by Rutgers Cooperative Extension (RCE). These laboratories provide New Jersey residents with analyses of soil and diagnoses of plant problems in an accurate and timely manner in an effort to meet the agricultural and environmental needs of the state.

The Rutgers Plant Diagnostic Laboratory (PDL) is a full-service plant health diagnostic facility. Since opening in 1991, the laboratory has examined nearly 46,500 samples submitted for plant disease and insect pest diagnosis, nematode detection, or insect identification and has become an important resource for commercial plant managers, pesticide applicators, and residential clients. The PDL is also an integral part of extension and university programs, providing diagnostic and educational services in support of the teaching, research, and outreach efforts of the School of Environmental and Biological Sciences and NJAES.

The PDL is on the front lines in the detection of pathogens and insects that have had significant impact in New Jersey. In 2013, the lab was the first to identify boxwood blight from New Jersey landscapes and nurseries, and in 2016 began accepting emerald ash borer specimens. Along with federal and state regulators, PDL is part of the Cooperative Pest Survey Team, which participates in pest monitoring programs, including those for walnut twig beetle and Ramorum blight.

The Rutgers Soil Testing Laboratory (STL) processes an average of more than 8,000 samples each year for chemical and/or physical analysis. The lab plays an integral role in soil nutrient management for horticultural, agronomic, and environmental assessments for the public and RCE, and programs for the school and NJAES.

While the STL continues to serve the soil analysis needs of gardeners, farmers, companies, golf courses, government agencies, and NGOs, it is now a key resource for urban communities by providing soil lead screening. For example, in 2016, lead screening was conducted on 159 samples, revealing about 35% with lead concentrations above currently accepted levels for vegetable gardens.

The bulk of samples submitted to the lab are for fertility and pH analysis, with 47% of soil samples that were tested for fertility showing deficiencies of at least one macronutrient (phosphorus, potassium, calcium, magnesium), 33% of soil samples had pH below the optimum range for the selected crop, and 26% had pH above the optimum range. The Soil Testing Lab is also a valuable resource for university researchers who submit samples that assist their work in evaluating fertilizer needs of various crops, assess soil microbial respiration as a measure of soil health, and establish optimum background conditions for other studies.
Youth and Community Development

The work and impact of Rutgers Cooperative Extension specialists, agents, and staff members was celebrated during our 250th anniversary year. RCE community-engaged scholars continue to be recognized by peers across the country as leaders in their respective fields, and our innovative outreach and educational programs again have received numerous regional and national awards. We also recognize the lifetime achievements of faculty members who have retired as Rutgers University emeritus faculty, and in doing so have opened the doors of opportunity for new entrants into our academy of extension educators.

Larry S. Katz
Director, Cooperative Extension

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4-H County Fairs Solidify Rutgers’ Connection to New Jersey

The highlight of the 4-H year in New Jersey has long been the county fair, with each fair serving as a living showcase of the accomplishments of local 4-H members. Whether demonstrating new skills or exhibiting a project, 4-H youth have the chance to share their work with others at the 20 county fairs held around the state between June and October that collectively attract over 500,000 attendees.

The county fair has provided an opportunity to display the agricultural achievements of New Jersey residents for well over 300 years, starting with the oldest such fair in Cumberland County in 1695. Mercer County records the first 4-H fair, which was held in 1919 in New Jersey. Rutgers’ involvement in county fairs in New Jersey started within the last century, not long after the creation of the Extension Service in 1914. Demonstrations and exhibits by 4-H youth showcased the skills and knowledge base that was critical for a successful future in a rural economy.

For many years, the 4-H projects focused solely on agriculture and homemaking. And while you can still find many examples of traditional 4-H projects like cows and cooking, today you can find a 4-H project to fit almost any interest. In addition to showing livestock and horses, 4-Hers now demonstrate their animal science knowledge by exhibiting small animals and companion animals like cats and dogs.

Beyond animal exhibits, 4-Hers also demonstrate their technology skills with projects like robotics, model trains, model airplanes, and remote control cars. Today 4-H exhibits highlight skills and knowledge that are transferable to a wide variety of careers.

More than 10,000 4-H members across the state prepare projects for exhibit at the fairs and in process, they learn and reinforce critical life skills like responsibility, record keeping, teamwork, leadership, and community service. Supporting these youth are more than 3,000 caring adult volunteers who guide them through their 4-H experience and create an environment for them to learn and grow.

In 2016, the New Jersey county fairs had a special addition. In celebration of the 250th anniversary of the founding of Rutgers—the eighth oldest institution of higher education in the U.S.—county fairs from Cape May to Sussex hosted a special Rutgers 250 booth commemorating Rutgers’ historic beginnings. Fairgoers were invited to take part in a reenactment of the signing of the original charter of Queen’s College, which evolved into the university we know today.

Visitors to the Rutgers 250 booth received giveaways in honor of this significant occasion and many fairgoers stopped by to share their Rutgers experiences. Some told stories of their days on one of the university’s campuses and many shared how Rutgers played a role in their lives right in their local communities through Cooperative Extension programs. The anniversary was an opportunity to celebrate Rutgers’ deep connection to New Jersey, and county fairs are an excellent way to highlight the connection and value of RCE and NJAES to communities throughout the Garden State.
STEM Programs: 4-H Rutgerscience and RCE of Ocean County

4-H Rutgerscience Saturdays is a Science, Technology, Engineering, and Mathematics (STEM) education program designed to connect middle school-age youth with Rutgers faculty and inspire them to become scientists and engineers. The students, who come from as far as Cape May, NJ, and Westchester, NY, have the opportunity to engage in hands-on activities and demonstrations that highlight a wide variety of STEM disciplines offered at Rutgers. Led by science, engineering & technology 4-H agent Janice McDonnell, the program partners with various Rutgers departments as well as tech companies. Department of Food Science undergraduate student and Aresty fellow Alexia Ciarfella demonstrated her new patent pending “Luminescent Lunchbox” program and developed a series of activities including “Rainbow Ghost,” demonstrating the fluorescent properties of food. Private industry leader Edmund Scientific and the Rutgers Department of Physics and Astronomy offered an exciting program in optical science. The season ended with a field program with environmental science graduate student Nick Henshue tracking bats at the Rutgers Gardens.

Ocean County’s 4-H agent Tamara Pellien and county agent Steven Yergeau collaborated to help educators put STEM concepts to use in new and innovative ways. Their partnership developed two programs, “Water Engineers” and “Growing with Vertical Gardens” to help educators learn program topics and then lead activities to implement projects in their districts.

“Water Engineers” focuses on watershed education and stormwater pollution and on implementing service learning projects to alleviate pollution. Workshops were conducted with educators from five schools who were provided materials to build a watershed model and information on options for the service learning projects. The program included funding for the service learning projects, which was used for five rain barrels, native plants for two pollinator gardens and a rain garden, and two planter boxes and vegetable seedlings for students to grow.

“Growing with Vertical Gardens” implements urban horticulture and nutrition education, utilizing a vertical garden in the classroom. Urban schools face limited green space that could be incorporated into their education, so the project provides upright vegetable gardens in lieu of a traditional school garden. “Growing with Vertical Gardens” is working in two schools in Ocean County to build and maintain the vertical gardens, as well as learning about botany and horticulture.

By involving educators and students in local environmental issues, they become invested in the sustainability of local resources. Helping the diverse population in Ocean County adapt to a changing landscape while enhancing their education with science-based activities can be met through collaboration.
Promoting Financial Literacy Education Through Financial Wellness Road Trip

Rutgers Cooperative Extension (RCE) is part of a network of financial education providers in New Jersey through the JumpStart Coalition affiliate called the New Jersey Coalition for Financial Education. RCE is the originator of the award-winning Small Steps to Health and Wealth™, a national Cooperative Extension program developed by Rutgers educators to motivate Americans to take action to improve both their health and personal finances.

Among the wide range of programs promoting financial literacy in 2016, financial resource management specialist Barbara O’Neill organized a one-hour “lunch and learn” seminar titled, “The Road to Financial Wellness: Campus Edition,” for about 50 campus faculty, staff, and visitors in June 2016. The Rutgers seminar was the prequel to a 107-day financial education road trip across the U.S. by Phroogal, a financial education startup that originated in Elizabeth, NJ.

Phroogal has partnered with nonprofits, credit unions, community organizations, colleges, and universities, including Rutgers, as well as financial technology companies across the U.S., starting with its initial 10,000-mile road trip, The Road to Financial Wellness, in 2015.

Phroogal founder Jason Vitug, a 2007 graduate of the Rutgers Business School and author of the book, You Only Live Once, addressed the importance of life planning and wise spending, stressing key points like, “cutting expenses is more powerful than increasing income” and “a bargain is not a bargain unless you need it.” He encouraged attendees to “envision the life you want to live” and “to have a life plan—not just a financial plan.” Vitug also warned about the dangers of spending at or above your income and described how he accumulated credit card debt that began with a free Frisbee at a table hawking student credit cards before federal laws banning such practices were enacted.

The event included a panel discussion about financial wellness and strategies to achieve it. In addition to O’Neill, panelists included Pam Callender, marketing director for Rutgers Federal Credit Union, and Kim Cole, education director for Navicore Solutions, a credit counseling agency. O’Neill stressed that “future-mindedness is a key personality trait that has been linked with successful financial outcomes.”

A 2015 study found that a long planning horizon plays a key role in explaining household asset accumulation and financial security. Surveys conducted annually by the Consumer Federation of America have also found that people with a “savings plan with specific goals” save more successfully than non-planners. Planners are more careful spending money and more likely to make savings progress and have sufficient savings for emergencies and retirement.

O’Neill and RCE colleagues are committed to promoting financial awareness among educators and residents alike, with the aim of building stronger and more financially secure communities.

29 Youth and Community Development
Programming for Clientele with Developmental Disabilities

According to the Centers for Disease Control and Prevention, there are more than six million individuals in the U.S. with developmental disabilities, and 1-in-6 children between the ages of 3 and 17 with one or more developmental disabilities or delays. These disabilities include learning disabilities, attention deficit disorder and attention deficit hyperactivity disorder, autism spectrum disorders, and intellectual disability, among others, and are recognized as conditions that lead to functional limitations in language, learning, social skills, and behavior.

As Extension professionals whose programming is inclusive and open to people of all abilities, it is important to possess the knowledge and skills necessary to effectively engage clientele with developmental disabilities in outreach programs. A literature review revealed that there are limited training opportunities for outreach educators and volunteers who design and implement programs for youth and adults with developmental disabilities in schools and community settings. To help fill this identified gap, training materials for Extension personnel, volunteers, and other educators were developed by RCE in order to help increase understanding of the abilities, challenges, and needs of those with developmental disabilities and to assist educators in being prepared to deliver more effective and meaningful programming.

Created by Michelle Brill, Mercer County educator in the Department of Family and Community Health Sciences, and Jeannette Rea-Keywood, state 4-H agent in the Department of 4-H Youth Development, the new initiative, “Programming for Clientele with Developmental Disabilities Professional Development Series,” is being offered as an online and in-person training for Extension professionals, volunteers, and formal and non-formal educators. The purpose of this training is to equip educators with a better understanding of developmental disabilities and how they impact learning and behavior. It encompasses effective instructional techniques and program modifications and accommodations that promote successful learning for clientele with developmental disabilities in an inclusive setting. The series also raises participants’ awareness of how to communicate respectfully and appropriately with and about people who have disabilities by using Person-First Language. This recognizes the person first and who s/he IS, not what s/he HAS.

The series was launched in September 2016, with participants from all Cooperative Extension departments. The Programming for Clientele with Developmental Disabilities Professional Development Series familiarizes educators with current disability laws, regulations, resources, and support that will enable them to effectively engage this population in Extension programming.

The Programming for Clientele with Developmental Disabilities Professional Development Series was one of the first two award recipients of the John and Anne Gerwig Director’s Fund for Rutgers Cooperative Extension.
Economic Development

NJAES connects New Jersey constituencies with Rutgers' capabilities with the goals of building viable businesses and industry sectors, developing sustainable and vibrant communities, catalyzing collaborations, and attracting/retaining innovative companies in the state. With faculty, staff, and facilities in all 21 counties, NJAES is well positioned to identify emerging economic issues, nurture solutions to these issues, and build the economic resiliency of the state's industries and communities.

Margaret Brennan-Tonetta
Director, Economic Development

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Providing Leadership in Food Innovation

The Rutgers Food Innovation Center (FIC) is the food business incubation and economic development accelerator program of NJAES, providing extensive programs in training and workforce development, customized and comprehensive business and technical mentoring services, and USDA- and FDA-inspected food processing facilities. The FIC services New Jersey businesses from locations in Bridgeton and Piscataway and provides the critical resources needed by food entrepreneurs to design, develop, commercialize, and manufacture value-added food products for sale to retail and foodservice markets. Over 2,000 clients have been served by the FIC, to date.

In 2016, FIC was named "Food Incubator of the Year" by the International Business Innovation Association (InBIA) in the inaugural year for this award. Previously, InBIA had recognized FIC as “Incubator of the Year” among all business incubation programs globally, due to its unique service model. InBIA also designated the Rutgers FIC as a Soft Landing site, which is a coveted certification program for incubators that have specialized services and successes in international business attraction. Globally, there are 31 InBIA-recognized Soft Landings programs and the Rutgers FIC is the only food-focused Soft Landings program.

FIC has continually expanded and enhanced its services, programs, and its geographic reach. In 2016, it completed feasibility studies for two new programs in New Jersey that will result in a continuum of services and a diversity of space requirements that both entrepreneurs and established businesses require during the various stages of their growth. One study was for the creation of the Paterson Food Hub, located in a 30,000 sq. ft. facility in the City of Paterson, which would service small start-ups and larger food businesses, and include a large area for community education and entrepreneurship training. The other study completed was for a 30,000 sq. ft. Food Industry Commercialization Center in Bridgeton, which would service international food businesses, regional processors, and FIC “graduate” companies.

Rutgers FIC also created a food business accelerator program called RutgersX, which services its high-growth “gazelle” clients with strategic mentoring and a platform for access to funding. The RutgersX program, launched during the fall of 2015, was recognized by the U.S. Small Business Administration in its first Growth Accelerator Fund competition held the same year.

FIC is leveraging its historical successes with international businesses, its designation as the only InBIA-recognized Soft Landings food-based program in the world, and New Jersey’s strategic location as the gateway to the U.S. market. It continues to foster partnerships with international organizations to attract global food businesses to NJ and today has clients that originate from Italy, Spain, Greece, Israel, Jamaica, and Columbia.
Equine Science Center Celebrates 15-year Milestone

Since its inception in 2001, the Rutgers Equine Science Center (ESC) has established itself prominently within state, national, and international equestrian communities through its research and outreach programs; strategic partnerships with state and federal agencies as well as private entities; a dynamic website; and the widespread recognition and acknowledgment it has received as a result of the impact of its programs. The ESC is the force behind connecting invaluable research findings to the greater community and in promoting best management practices and knowledge to those caring for and working with horses.

In 2016, the center celebrated its 15-year anniversary of delivering “Better Horse Care through Research and Education,” and serving the needs of its constituents worldwide. It has assisted countless horse owners from around the world through its robust “Ask the Expert” section on its website, which had a major facelift in 2015, to offer greater interactivity and new search functionality. In addition, the Gwendolin E. Stableford Endowed Equine Research Fund was established to ensure funding for equine research at Rutgers in perpetuity. The ESC study, “The NJ Horse Industry 2007: Economic Impact,” remains the gold standard for quantifying the importance of the equine industry and has been used as the template for such studies worldwide.

Anchored by over 30 Rutgers faculty, staff, and students from multiple departments as well as a dozen outside academic collaborators, the center’s expertise ranges from equine nutrition and endocrinology to economic development and environmental stewardship. Collectively, their research has led to the publication of studies with global impact. The ESC’s study of aging in horses has resulted in recommendations for the care and wellbeing of the older horse that have been adopted by horse owners everywhere. Faculty and students in the Equine Exercise Physiology Lab are actively engaged in finding ways to maximize performance in equine athletes.

The Ryders Lane Best Management Practices Demonstration Horse Farm represented the first of its kind in the nation when it began in 2005. Rutgers faculty and students continue to lead a regional effort, “NE-1441 USDA Regional Project, Environmental Impacts of Equine Operations,” which began its second five-year project cycle in 2014. This group includes more than 15 scientists at other institutions, conducts research and outreach concerning the impact of horses and farm management upon the environment as well as water, air, and soil quality.

The ESC continues to support horse racing in New Jersey through its efforts to quantify the impact of racing to the state and to investigate the effects of certain performance-altering agents on the performance and wellbeing of the equine athlete.
A strong tradition of cutting-edge research at NJAES’ farms, field stations, institutes, and centers works in concert with strong outreach and education through Rutgers Cooperative Extension to ensure the wellbeing of New Jersey residents and business enterprises. Your private support can help to widen the impact of all our programs, ranging from traditional agriculture and fisheries research, to critical health and nutrition projects, to a host of new and emerging youth and community development activities in every New Jersey county.
Rutgers Gardens Celebrates 100 Years

Anchored to the George H. Cook Campus of Rutgers University and a key unit of NJAES, the Rutgers Gardens is a largely self-sustaining operation. It is open 365 days a year and is one of the few botanical gardens in the country that currently does not charge an entrance fee. The Gardens serves multiple roles promoting and providing accurate information about public horticultures and the connection among plants, human health, and nutrition.

A wide range of public activities help support the more than 180 acres of maintained and natural areas of the Gardens, which boast one of the largest collections of American hollies in the U.S. as well as pollinator gardens, a bamboo forest, and more than 10 other diverse, beautiful horticultural exhibits.

In 2016, the Gardens launched its 100th anniversary with a new mission statement and adopted the tagline, “Where the Future of Horticulture is Grounded in our Past.” As part of its centennial celebration, the Gardens collaborated with a national breeder of bearded iris to designate a new cultivar, ‘Centennial Charm’, and installed two permanent benches and a commemorative plaque in the Roy H. DeBoer Evergreen Garden. The Gardens recast its annual DOC award, named for and inspired by former Rutgers professor and Gardens director Bruce “Doc” Hamilton, as a national horticulture award called the Bruce Hamilton Award.

In a sign of its growing stature, the Gardens was designated a Horticultural Landmark by the American Society for Horticultural Science and it received a prestigious national Museum Assessment Program grant to conduct a comprehensive review of its plant collections.

The Rutgers Gardens Advisory Board has begun the process of looking strategically towards the expansion of its farmers market, which today operates seasonally from May through November. Approaching its 10th season, the Rutgers Gardens Farmers market is working to secure a more permanent structure to be called Cook’s Marketplace, which would allow it to operate year-round. As envisioned, the structure will convey the horticultural, ecological, and educational mission of the Gardens.

In addition, the expansion of the Student Farm at the Rutgers Gardens will allow undergraduate students to experience firsthand the full cycle of food production from seed, to seedling, to the field, to harvest, and finally to the consumer. A true outdoor classroom, the farm offers hands-on courses throughout the year.

Contact Melissa McKillip at 848-932-4214 or mckillip@rutgers.edu to discuss how you can support the development of the Rutgers Gardens as a leading public botanical garden in New Jersey and the region, and as a community partner in accessing healthy and locally grown food.
Make an Impact at NJAES and Beyond

Rutgers is home to a wide range of off-campus research stations and centers across New Jersey as well as several campus-based centers and institutes, whose work contributes to the statewide economic viability of agriculture and fisheries, and allied food industries; management of environmental and natural resources; and holistic and transformative approaches to health, nutrition, and community wellness.

The Rutgers University Marine Field Station (RUMFS) is located across from the Little Egg Inlet in the Mullica River-Great Bay estuary, one of the most pristine estuaries on the East Coast. Led by fish biologist and distinguished professor Ken Able, this unique research and teaching facility provides relevant, quantitative analysis on the effects of climate change for many of the economically, recreationally, and commercially important fish species in the state and region. RUMFS’ extensive collections of larval and juvenile fishes, built-up over more than a quarter century of research, provide long-term data that is vital to supporting New Jersey fisheries.

RUMFS is an ideal laboratory for training the next generation of marine scientists via 10-week, on-site undergraduate research internships on topics like the ecology and life history of fishes and horseshoe crab nurseries, or supporting current research efforts underway at the field station. In addition, RUMFS has access to high-salinity, high-quality water for holding animals in its seawater laboratories, which were compromised by Superstorm Sandy and require additional funding to repair and upgrade these critical facilities.

The Rutgers Clifford E. and Melda C. Snyder Research and Extension Farm in Pittstown, NJ, conducts numerous agricultural research trials on its 390 acres in Hunterdon County, including breeding, variety trials, insect and disease control, and cultural propagation for an array of tree fruit, vegetables, herbs, and hops. Throughout the growing season, the farm has tons of produce on hand but unlike commercial farms, its harvests are not destined for retail markets. For more than 20 years, Snyder Farm has harvested and distributed its top-quality, farm-fresh produce to food banks in Somerset, Morris, Union, Middlesex, Essex, Passaic, Mercer, Warren, Hunterdon, and Sussex counties. Food bank clients in these counties, often with limited access to fresh fruits and vegetables, are the beneficiaries of Rutgers Against Hunger, a universitywide initiative working to address the issues of hunger across the state of New Jersey.

Snyder Farm also helps local growers expand their produce offerings by selling them the tree fruit directly to supply their roadside markets. This effort generates revenue to maintain the research farm’s orchard and is a joint effort of the New Jersey Horticultural Society and NJAES. Interns—ranging from high school to graduate school—work alongside farm manager Ed Dager, learning various aspects the farm’s research and outreach efforts, and gaining both vital hands-on experience into the complexity and scientific nature of farming as well as critical insight into their future career paths in agriculture and allied industries.

You can support the expansion of these and other NJAES initiatives by contacting Melissa McKillip at 848-932-4214 or mckillip@rutgers.edu.
Board of Managers

The New Jersey Agricultural Experiment Station Board of Managers, appointed by the Rutgers Board of Governors, is an advisory group to the Executive Dean of Agriculture and Natural Resources and Executive Director of NJAES. The board consists of a representative from each county nominated by the County Board of Agriculture or Board of Chosen Freeholders, and a six-member statewide advisory committee. The President of Rutgers, the Executive Director of NJAES, and the State Secretary of Agriculture serve as ex officio members.

County Contacts

Atlantic...........................................August Wuillermin
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Burlington ......................Raymond Hlubik
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Cape May ..............Allen D. Carter, Jr.
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Essex........Frank Yesalavich, Corresponding Sec'y
Gloucester ..................................Ann Dorsett
Hudson........................................Vacant
Hunterdon .............Meredith Peters, Vice President
Mercer .......................Jessica Niederer
Middlesex..................Robert VonThun
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Salem.........................David Dolbow
Somerset ..............Kenneth Osterman
Sussex...........................Raj Sinha
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Statewide Advisory Committee

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Food Science........................................................................Pearl Giordano
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Off-Campus Stations

Clifford E. and Melda C. Snyder Research and Extension Farm (Rutgers Center for Sustainable Agriculture), Pittstown
snyderfarm.rutgers.edu

Haskin Shellfish Research Laboratory, Bivalve
hsrl.rutgers.edu

Lindley G. Cook 4-H Youth Center for Outdoor Education, Branchville
nj4hcamp.rutgers.edu

New Jersey Aquaculture Innovation Center, Cape May
aic.rutgers.edu

New Jersey Center for Wine Research and Education, Upper Deerfield
njvines.rutgers.edu

Philip E. Marucci Center for Blueberry and Cranberry Research and Extension, Chatsworth
pemaruccicenter.rutgers.edu

Rutgers Agricultural Research and Extension Center, Upper Deerfield
njaes.rutgers.edu/rarec

Rutgers EcoComplex (Clean Energy Innovation Center), Bordentown
ecocomplex.rutgers.edu

Rutgers Food Innovation Center–North, Piscataway
njaes.rutgers.edu/ficn

Rutgers Food Innovation Center–South, Bridgeton
foodinnovation.rutgers.edu

Rutgers Fruit and Ornamental Research Extension Center, Cream Ridge
njaes.rutgers.edu/creamridge

Rutgers Plant Science Research and Extension Farm, Adelphia
njaes.rutgers.edu/plantscience

Rutgers University Marine Field Station, Tuckerton
marine.rutgers.edu/rumfs

YE2S Center–Camden, Newark, Ocean
teeemgateway.rutgers.edu/

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Michael Green, director.


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